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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/509,377	08/28/2000	Sergey Matasov		9553

TITLE: Endoscope with disposable cartridges for the invagination of endoscopic tube

United States Patent and Trademark Office
Honorable Commissioner for Patents
Art Unit 3739 Examiner Mr. Leubecker, John P.
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ART UNIT	PAPER NUMBER
3739	

DATE MAILED: 02/03/2003

Substitute

specification, claims and drawing

of the application 09/509,377

These objectives have been achieved by the fact that the claimed endoscope comprises:

- an invaginator made of everting tube, arranged by pleats, formed in the shape of compact hollow cylinder;
- a disposable cartridge combining the invaginator with auxiliary elements;
- an endoscopic tube ensuring fixation of a cartridge;
- a mechanism for introduction of tube, ensuring together with a cartridge insertion of a tube;
- a system of extraction-intraction of traction lines ensuring bending of the tube's distal end with hydro-manual or pneumo-manual or hydraulic or pneumatic drive;
- a hydraulic or pneumatic intensifier of introduction and extraction of biopsy forceps and hydraulic or pneumatic intensifier of traction line of biopsy forceps.

A compact hollow cylinder of the invaginator can be formed of tightly compressed in longitudinal and transverse directions pleats of different forms of an eversible thin-walled tube placed at any angles with the longitudinal axis of an endoscopic tube. The cylinder has recurrent narrowings of an external diameter and widenings of its internal diameter. There are possible two embodiments of the cylinder. In one embodiment the gap 25 is keeping both at putting of cartridge on the endoscopic tube 3, and at the working pressure in the cavity 14. In other – the gap 25 is necessary only for putting of cartridge.

A disposable sterile cartridge for invagination consists of a shell which has a projection at its proximal end, comprising: an invaginator; a compressed spring; its fixator; a spring distancer in which the distal seal of the endoscopic tube is located, which is joined to an uneverted end of the invaginator; a preservative of the distal part of the endoscopic tube joined at the proximal end to a spring stop, but at the distal end - to the tip with elements for hermetic joining to the endoscopic tube, while on the shell is located a proximal seal of the endoscopic tube with the anal dilator having the channel in its wall, but at the distal end of the shell the everted end of the invaginator is fastened. In addition to elements for hermetical joining to the endoscopic tube, the tip may have a protective glass and a channel for glass washing.

An endoscopic tube is supplemented with: - an internal transverse pleats of its external cover; - two air-ducts, the larger one has a lateral opening into the cavity of the proximal seal of the disposable cartridge for invagination, but the smaller - into the cavity of distal and proximal preservatives; - areas for hermetical fixation of preservatives' ends; - a proximal preservative.

The mechanism for introduction of the endoscopic tube consists of the cylinder with two pistons, which are interconnected with distancers and an elastic tube. The cylinder is joined with the cartridge for invagination of the endoscopic tube. The cavity between pistons and the elastic tube is connected to the source of pressure or atmosphere (negative pressure) through the cock. The cavity between the distal piston and the proximal seal of the endoscopic tube through the cock is connected to the source of negative pressure or atmosphere (overpressure). The cocks can be placed in the pedals but the spring, which returns pistons to their home position can be located in the cavity between the proximal seal of endoscopic tube and the distal piston.

The system of extraction-intraction of traction lines ensuring management over the endoscopic tube's distal end, has a hydro-manual or pneumo-manual or hydraulic or pneumatic drive and creates exertion at the distal end of traction lines. The system includes sources of overpressure and negative

proximal part – to the compressed spring 10. Everted end 12 of invaginator 23 is connected to shell 22 by ring 16. Invaginator 23 has narrowings and widenings 24, as well as gap 25 with distal preservative 26, at that the gap 25 is keeping also at working pressure in the cavity 14. Ends of distal 26 and proximal 27 preservatives and corresponding to them places of tube 3 have areas 28 for interconnection and hermetization. Seal 29 on end 7 of invaginator 23 separates cavity 14 from cavity 25, which communicates with the intestinal cavity. A distancer 30 prevents deformation of seal 29 by spring 10. Ends of compressed spring 10 are based on distancer 30 and stop 11 at the end 28 of preservative 26. Stop 11, in its turn, is positioned on the projection 31 of shell 22. The distal end of preservative 26 ends with tip 6 with channels 32 for washing of protective glass 33 and blowing-up of intestines, as well as an element for connection to endoscopic tube 3. On the border of narrow and broad parts of shell 22 there is an area of intermediate diameter with indented elastic ring 34 for fixation of compressed spring 10. Channel 35 of anal dilator 19 is used for decompression of intestines during intubation. In the tube 3, besides the enumerated, there are elastic tubes 36, 37 comprising springs 38, 39 and traction lines 40, 41. Tubes 36, 37 are connected to springs 38, 39 with thread 42. Near mechanism 43 for bending the distal end of tube 3, ends of tubes 36, 37 are closed with plugs 44, which also connect springs 38, 39 with traction lines 40, 41. Proximal ends of tubes 36, 37 are connected with sources 45 of overpressure and negative pressure. Proximal ends of traction lines 40, 41 are connected with their manual extractors-intractors 46, but the latter - with element 47 which ensures synchronous feeding of negative pressure into the cavity of traction line 40 which is being extracted and of overpressure into the cavity of traction line 41 which is being introduced. Endoscopic tube 3 has internal pleats 48 of external cover, air-duct 49 with two openings 50 for vacuum fixation of preservatives 26, 27 to tube 3 and also has removable sleeve gasket 51. Control block 2 has cock 52 of air-duct 49. Seal 13 is hermetically connected to mechanism 53 for introduction of endoscopic tube 3. Mechanism 53 for introduction of tube 3 is operated by pedal 54 but lever 55 realizes bending of tubes end. Cylinder 56, two pistons 57, distancers 58 and elastic tube 59 limit cavity 60, which is connected with source of overpressure by means of cock in pedal 54. Cavity 61 comprises return spring 62 and is connected with negative pressure source by means of cock in pedal 54. Seal 64 and nut 65 are mounted on biopsy forceps 63, but piston 66 is positioned at their distal end. Seat for seal 64 and nut 65 is located at entry 67 to biopsy channel, which is positioned with cock 68 on control block 2. Sylphon 69, which serves as source of overpressure and negative pressure in the intensifier of traction line of biopsy forceps 63, can be combined with its handle.

Marks made on preservative 27 and tube 3 serves for their correct positioning. Then mechanism 53 is mounted on tube 3 and cartridge for invagination is fixed. Pressing of cock 52 will ensure vacuum fixation of preservatives 26, 27 to tube 3. After introduction of seal 13 into cylinder 56 endoscope preparation for work is completed.

After the patient has been placed on an endoscopic table a cartridge is oiled and introduced into the rectum and its ampoule is examined as if with a rigid rectoscope. The pressure in cavity 14 is raised by pressing cock 17 thus freeing distancer 30 from coupling with fixator 34 and shell 22. Thereby spring 10 is released and it is possible to proceed with invagination of tube 3. Eversion of invaginator 23 and introduction of tube 3 into the colon occurs under working pressure in cavity 14 at the moments of pressing pedal 54. During endoscopy intestines are to be distended. Gas into intestines is constantly supplied through gas/liquid channel of tube 3 and through channel 32 of tip 6 thus preventing intestinal

47 – element for extraction-intraction of one or two pairs of traction lines;

48 - pleats of external cover of tube 3;

49 – air-duct into cavity of preservatives 26, 27;

50 - distal and proximal openings of air-duct 49 on tube 3;

51 - sleeve gasket;

52 – air-duct 49 cock on control block 2;

53 –mechanism for insertion of endoscopic tube 3;

54 – pedal for switching on mechanism 53;

55 - lever of element 47, made in a shape of cross-piece;

56 - cylinder of mechanism 53;

57- pistons of cylinder 56;

58 – distancers between pistons 57;

59 - elastic tube, attached to pistons 57;

60 - hermetic cavity, enclosed by elastic tube 59 and pistons 57;

61 - hermetic cavity, enclosed by seal 13 and distal piston 57;

62 - spring returning pistons 57 to home position;

63 - biopsy forceps;

64 - seal of entry 67 into biopsy channel;

65 - nut, fixing seal 64;

66 - piston of biopsy forceps;

67 - entry into biopsy channel;

68 - cock feeding the overpressure or negative pressure into biopsy channel;

69 - source of overpressure and negative pressure connected with cavity of biopsy forceps 63;

70 - cutters of biopsy forceps 63;

71 - distal intensifier (drive) of traction line of the cutters 70.